CLAIMS

What is claimed is:

1. A method for current limiting in a DC-to-DC converter, the method comprises:

determining a current loading duty cycle of the DC-to-DC converter;

comparing the current loading duty cycle with a zero loading duty cycle of the output; and

when the current loading duty cycle exceeds the zero loading duty cycle plus a duty cycle loading offset, limiting duty cycle of the DC-to-DC converter to the zero loading duty cycle plus the duty cycle loading offset.

2. The method of claim 1, wherein the duty cycle loading offset corresponds to desired maximum inductor current of the DC-to-DC converter.

3. The method of claim 1 further comprises:

equating the zero loading duty cycle to $\frac{Vout - Vbat}{Vout}$, where Vout represents an output voltage of the DC-to-DC converter and Vbat represents voltage of a battery.

4. The method of claim 1 further comprises:

equating the duty cycle loading offset to $I_{CL}*R_{T0}$, wherein I_{CL} represents the desired current limit of the inductor current and R_{T0} represents an output switching transistor of the output.

5. The method of claim 1 further comprises:

equating the current loading duty cycle to $\frac{Vout - Vbat + Icl * Rt0}{Vout}$, where Vout represents an output voltage of the DC-to-DC converter, Vbat represents voltage of a battery, Icl represents the desired current limit of the inductor current, and Rt0 represents an output switching transistor of the output.

6. A method for current limiting a DC-to-DC converter, the method comprises:

monitoring duty cycle of the DC-to-DC converter to produce a monitored duty cycle;

equating the monitored duty cycle to an inductor current based on a relationship between the inductor current and the duty cycle of the DC-to-DC converter to produce an equated current;

comparing the equated current with a current limit threshold; and

when the equated current compares unfavorably with the current limit threshold, limiting the inductor current based on the current limit threshold.

7. The method of claim 6, wherein the monitoring the duty cycle further comprises:

interpreting an output regulation signal that regulates an output of the DC-to-DC converter to determine a digital value; and

converting the digital value to a percentage of a maximum digital value to produce the monitored duty cycle.

8. The method of claim 6, wherein equating the monitored duty cycle to the inductor current further comprises:

solving an equation of $DC = \frac{Vout - Vbat + Icl * Rt0}{Vout}$, where DC represents the duty cycle of the DC-to-DC converter, Vout represents an output voltage of the DC-to-DC converter, Vbat represents voltage of a battery, Icl represents the desired current limit of the inductor, and Rt0 represents an output switching transistor of the output.

9. An on-chip DC-to-DC converter comprises:

a regulation module operably coupled to produce a regulation signal;

output capacitance operably coupled to the first output;

an integrated circuit (IC) pad for coupling to an external inductor;

an output stage operably coupled to the output capacitance, the IC pad, and the regulation module to produce an output based on the regulation signal, wherein the regulation module provides current limiting of the output by:

determining a current loading duty cycle of an output of the DC-to-DC converter;

comparing the current loading duty cycle with a zero loading duty cycle of the output; and

when the current loading duty cycle exceeds the zero loading duty cycle plus a duty cycle loading offset, limiting duty cycle of the output to the zero loading duty cycle plus the duty cycle loading offset.

10. The DC-to-DC converter of claim 9, wherein the duty cycle loading offset corresponds to desired maximum inductor current of the DC-to-DC converter.

11. The DC-to-DC converter of claim 11, wherein the regulation module further functions to:

equating the zero loading duty cycle to $\frac{Vout - Vbat}{Vout}$, where Vout represents voltage of the output and Vbat represents voltage of a battery.

12. The DC-to-DC converter of claim 9, wherein the regulation module further functions to:

equating the duty cycle loading offset to $I_{CL}*R_{T0}$, wherein I_{CL} represents the desired current limit of the inductor current and R_{T0} represents an output switching transistor of the output.

13. The DC-to-DC converter of claim 9, wherein the regulation module further functions to:

equating the current loading duty cycle to $\frac{Vout - Vbat + Icl * Rt0}{Vout}$, where Vout represents voltage of the output, Vbat represents voltage of a battery, Icl represents the desired current limit of the inductor current, and Rt0 represents an output switching transistor of the output.

14. An on-chip DC-to-DC converter comprises:

a regulation module operably coupled to produce a regulation signal;

output capacitance operably coupled to the first output;

an integrated circuit (IC) pad for coupling to an external inductor;

an output stage operably coupled to the output capacitance, the IC pad, and the regulation module to produce an output based on the regulation signal, wherein the regulation module provides current limiting of the output by:

monitoring duty cycle of an output of the DC-to-DC converter to produce a monitored duty cycle;

equating the monitored duty cycle to an inductor current based on a relationship between the inductor current and the duty cycle for the output of the DC-to-DC converter to produce an equated current;

comparing the equated current with a current limit threshold; and

when the equated current compares unfavorably with the current limit threshold, limiting the inductor current based on the current limit threshold.

15. The DC-to-DC converter of claim 14, wherein regulation module further functions to monitor the duty cycle by:

interpreting an output regulation signal that regulates the output to determine a digital value; and

converting the digital value to a percentage of a maximum digital value to produce the monitored duty cycle.

16. The DC-to-DC converter of claim 14, wherein regulation module further functions to equate the monitored duty cycle to the output current by:

solving an equation of $DC = \frac{Vout - Vbat + Icl * Rt0}{Vout}$, where DC represents the duty cycle of the output, Vout represents voltage of the output, Vbat represents voltage of a battery, Icl represents the desired current limit of the inductor current, and Rt0 represents an output switching transistor of the output.